REMARKS

We have carefully reviewed the Final Office Action of December 22, 2004 and the cited art. Claims 1-53 are pending in the application. We note with appreciation the indication of allowability of Claims 17, 30, 36, 46 and 53 if rewritten in independent form.

Claims 1-16, 18-29, 31-35, 37-45 and 47-52 have each been rejected in view of Harada '248. (The claims stand rejected either under 35 USC 102 or 103 based on Harada alone or in combination with Gaston '051.) Applicants had previously argued that Harada does not teach the invention of the application, as noted in the Examiner's action. The Examiner disagrees. It appears that the disagreement between the Examiner and the applicants hinges on what Harada actually teaches.

Applicants have developed a novel method of detecting surge, or incipient surge, in a centrifugal compressor through the measuring of localized fluid flow. Specifically, the localized flow is detected in a recirculation zone in the inlet passage (upstream of the impeller), proximate to the impeller and the passage wall. This method is unique to the Applicants invention. See Specification at ¶¶ 17-18, 20, 25-26, for example, and at Figs. 2-4. The prior art teaches measurement of bulk fluid flow, flow rate across the compressor or system, or measurement of other parameters such as machinery vibration, temperature change, etc.

The Examiner and the Applicants apparently disagree concerning the teachings of Harada. The Examiner has indicated that Harada teaches that a sensor "S1" is "placed to monitor such parameters as fluid flow, flow rate, flow speed, etc. and Figure 5 shows the sensor S1 being placed in the inlet proximate the wall of the inlet passage and upstream of the impeller" and that the sensor is, therefore, "within the recirculation zone even if Harada, et al. does not explicitly disclose that the zone is called a recirculation zone." See Final Office Action, p. 2.

Applicants respectfully point out that the differences between Harada and the invention claimed in the application is not simply that Harada does not refer to a "recirculation zone." In fact, Harada does not recognize that any zone exists where *localized fluid flow* (as opposed to bulk flow rate) varies (decreases or reverses) prior to compressor surge. Having failed to even recognize the existence of such localized changes in flow, Harada, not surprisingly, does not attempt to *measure localized flow* within the zone. The

fact that Harada shows "a sensor" near the impeller, does not indicate that Harada is measuring the same parameters as Applicants.

In fact, Harada is not measuring the same parameters measured by Applicants – Harada's "flow" sensors measure the overall *bulk parameters* in the compressor system, not localized parameters at a specific location near the impeller and inlet wall. This is evident in Harada from both the absence of any teaching regarding localized flow measurements and the positive teachings regarding his parameter measurements and general methodology. The prior art teaches measurement of bulk parameter changes and nowhere does Harada indicate a change from this known method. If Harada had, in fact, recognized the ability to use *localized* flow change to predict surge, he would necessarily have pointed out the change from the prior art method of measuring *bulk* rates. Instead, nowhere does Harada teach or suggest measuring localized flow. Applicants respectfully submit that the Examiner has not pointed out anywhere that Harada teaches sensing localized fluid flow changes.

The flow rate referred to by Harada is a bulk flow rate measurement, just as his pressure sensors measure pressure for all of the fluid. Harada's sensor, if S1 is a flow sensor, is a bulk or total flow rate sensor, just as his pressure sensor measures bulk pressure of the fluid. Harada never teaches a sensor for measuring localized changes, but measures only the bulk flow rate into the compressor. In Col. 6, line 52, his sensor S1 is taught to be disposed on "the suction pipe," which in most applications would not be close enough to the impeller to detect a local re-circulation as required by the claims, and in any case is not taught to measure localized fluid flow rate changes.

Additionally, Harada's methodology is distinct from Applicants', further indicating that Harada is not and does not teach measuring the local flow parameters measured by Applicants. Harada's technique depends on measuring "vibrations" or "fluctuations" in a parameter, such as pressure, to indicate development of surge. Harada uses fluctuating signals, amplifiers and computers to compare and quantify the fluctuations. See Harada, Figures 7 and 25, for example. Harada only works if the parameters are fluctuating. Applicants do not rely on fluctuations in bulk flow but rather on a drop in local flow rate, which decrease may be steady without fluctuations. Applicants consider their invention methodology to be distinct from that of Harada on this basis.

As to the rejections of claims referring to "tangential" flow, Harada does not teach measuring tangential fluid flow at a localized area in the recirculation zone. Harada teaches

use of inlet guide vanes to control fluid flow rate at the inlet. When Harada discusses a tangential component to the inlet flow (Col., 12, l. 63), it is the bulk or average tangential angle of the flow in his flow equations as controlled by the guide vanes. For the current application, the tangential flow component is a local flow component at the sensor near the outer wall of the inlet passage, which occurs because the compressor is approaching surge even where the bulk flow or central flow does not have a tangential component and approaches the impeller directly. The substantial decrease in total flow referred to in Harada (Col. 2, l. 35) is the general decrease in bulk or total flow rate below the designed bulk flow rate at which any compressor will approach surge. Applicants measure the local flow decrease or reversal at one point (proximate the outer wall and impeller) while the overall flow is still positive and towards the compressor, even if reduced below the design bulk flow rate. This is distinct from the overall flow rate measurements in the suction pipe suggested by Harada.

As to Gaston, the flow reversals he speaks of and the corresponding temperature rise (Col. 1, l. 54) is the result of the global or total bulk flow reversal that is surge and not the local inlet flow reversal at a localized point that precedes surge.

Gunn teaches a method for increasing total or bulk flow rate to avoid surge, which is the typical method to avoid surge used for modern compressors. Regardless of the methodology of the detection of surge, increased bulk flow is the normal corrective action. Gunn, as others, tracks where a compressor is on its operating map, using mostly pressures and temperatures, in order to predict how close the compressor is to surge. Harada detects fluctuations in operating parameters. Applicants are not dependent on either of these approaches, fluctuation or mapping, and only Applicants measure a local fluid flow change close to the impeller and inlet wall, separate and distinct from a bulk or average flow change that is a fundamental indication of approaching surge.

Applicants believe the claims are in condition for allowance and respectfully request such action. If the Examiner wishes to discuss the claims, please do not hesitate to call the undersigned.

No fee is believed to be due. The Commissioner for Patents is hereby authorized to charge any additional fees relating to this paper or credit any overpayment to Deposit Account No. 50-3037. A duplicate copy of this fee authorization sheet is enclosed.

Appl. No. 10/083,232
Amdt. dated: February 22, 2005
Response to OA dated December 22, 2004

Date: February 22, 2005

Respectfully submitted,

CERTIFICATE OF FACSIMILE

I hereby certify that this correspondence is being facsimile transmitted to 1-(703) 872-9306 the Commissioner of Patents, Mail Stop: Non-Fee Amendments, P. O. Box 1450, Alexandria, VA 22313-1450.

on FEB 22, 2005
Date of Deposit

Jacqueline E. Butler
Typed or Printed Name of Person Signing Certificate

Jacqueline Butler
Signature of Person Signing Certificate

February 22, 2005
Date of Signature

Peter V. Schroeder, Reg. 42,132
CRUTSINGER & BOOTH, L.L.C.
1601 Elm Street, Suite 1950
Dallas, TX 75201-4744
(214) 220-0444, Fax (214) 220-0445

ATTORNEYS FOR APPLICANT